

658.1

ITEM	DESCRIPTION	UNIT
657010-*	3.00 LB CHANNEL POST	LINEAR FOOT (METER)
657011-*	BLANK	
657012-*	4.00 POUND BACK TO BACK CHANNEL POST	LINEAR FOOT (METER)
657013-*	BLANK	
657014-*	6.00 POUND BACK TO BACK CHANNEL POST	LINEAR FOOT (METER)
657015-*	BLANK	
657016-*	CLASS B CONCRETE FOOTING, PLAIN	CUBIC YARD (METER)
657017-*	CLASS B CONCRETE FOOTING, REINFORCED, ROADSIDE	CUBIC YARD (METER)
657018-*	POST REMOVAL	EACH
657019-*	PIPE POST, **	EACH
657021-*	BREAKSAFE COUPLINGS FOR A 572 SUPPORT	EACH
657022-*	BREAKSAFE COUPLINGS FOR CHANNEL POST	EACH

* Sequence number

** Key number

SECTION 658

OVERHEAD SIGN STRUCTURES

658.1-DESCRIPTION:

This item shall consist of the fabrication and erection of overhead bridge, cantilever, and butterfly sign supports and fastening accessories in accordance with the requirements of the Plans and of these Specifications. All details not specified or not shown on the Plans shall conform to the details and requirements set forth in the following Specifications and publications:

The Manual on Uniform Traffic Control Devices for Streets and Highways, latest issue, including revisions, as printed by the Federal Highway Administration, U.S. Department of Transportation. (Referred to as the MUTCD).

Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, latest issue, including revisions, American Association of State Highway and Transportation Officials.

658.2-MATERIALS:

Materials furnished by the Contractor shall be of new stock conforming to the requirements of the Standard Specifications, and shall meet with the approval of the Engineer.

All materials shall conform to the requirements of Division 700 of the Standard Specifications and shall also conform to the following requirements unless otherwise modified on the Plans. All referenced specifications for materials shall be the latest available specifications and revisions at the time of award of the contract.

658.2.1-Aluminum: Tubular aluminum supports of a uniform diameter

658.2.2.1

shall be fabricated from Alloy 6061-T6 or Alloy 6063-T6, ASTM B221, B429, or B 241 for extruded sections or ASTM B 209 for sheet sections.

Structural shapes and bars shall be Alloy 6061-T6, ASTM B 221, or B 308. Plates shall be Alloy 6061-T6, ASTM B209.

Castings for support top caps and horizontal member end caps shall be ASTM B 26 Alloy 356-F or Alloy 43, and shall be held in place by stainless steel set screws. The same type cap must be used throughout a project.

Aluminum hardware shall meet the requirements of 661.2.1.3. Steel nuts, bolts and washers used on aluminum structures shall be stainless.

Welding wire shall be in accordance with 658.4.

658.2.2-Steel:

658.2.2.1-Galvanized Steel: All steel items shall be galvanized in accordance with ASTM A 123 or ASTM A 153, unless otherwise specified.

Vertical poles, transverse horizontal beams and horizontal arms shall be tapered tubular sections or tubular sections of uniform diameter and shall have a minimum yield strength of 55,000 psi (380 MPa) after fabrication. All tubular sections shall have only one longitudinal weld. Any taper shall be uniform and continuous. Other tubular structural members shall be uniform in diameter and shall be fabricated from seamless or welded pipe conforming to ASTM A 501 or ASTM A 53, Type E or S, Grade B (hydrostatic tests are waived).

Tubular sections of a uniform diameter shall be fabricated from seamless and welded pipe conforming to ASTM A 501 or ASTM A 53, Type E or S, Grade B (hydrostatic tests not required).

Steel for other structural members, plates and structural shapes shall conform to ASTM A 36, except plates over 1 in. (25 mm) thick shall conform to ASTM A 572, Grade 42.

Support top and horizontal end cap castings shall be ASTM B 26 Alloy S5A or Alloy 356-F. Caps will be held in place by stainless steel set screws. The same type cap shall be used throughout the project.

Stainless steel bolts, nuts and washers for splicing flanges shall be AISI 300 series, commercial grade and passivated. High strength bolts and nuts for splicing flanges shall conform to ASTM A 325 or ASTM A 193-B7.

Reinforcing materials shall be in conformance with 709.1 to 709.4, inclusive, except that welded wire fabric may be furnished in rolls.

Anchor bolts shall be of sufficient size and strength to fully develop the bending moment of the shaft. **Anchor bolts (unless otherwise directed on the Plans) shall be fabricated from high strength steel, meeting ASTM A1554, Gr. 105.** Each bolt shall have the threaded end galvanized for a length sufficient to extend down through the grout and into the concrete foundation. Each bolt shall be provided with two heavy hex nuts and two heavy washers. Both nuts and washers shall be hot-dipped galvanized in accordance with ASTM A 153 and the nuts shall meet the physical, chemical and dimensional requirements of

658.2.2.2

ASTM A 563, Grade DH or ASTM A 194-2H.

Detailed properties, dimensions, bolt circles and appropriate backup calculations for any proposed alternate design anchor bolts shall be submitted to and approved by the Division before fabrication.

658.2.2.2-Weathering Steel: All components of the overhead sign supports including miscellaneous fixtures, shall be fabricated from plates, bars, standard W, M, and S shapes produced from steel conforming to ASTM A 588 and supplementary of AASHTO M 222, and tubes produced from steel conforming to ASTM A 618, Grade 1, and supplementary Table S1 of AASHTO M 222.

Expanded metal screen shall be fabricated from steel sheets conforming to ASTM A 606, Type 4, with special alloys to provide weathering properties equivalent to ASTM A 588 or ASTM A 618 steel. Framing plates for expanded metal screen shall be fabricated from steel conforming to ASTM A 588 or ASTM A 242.

Bolts, nuts and washers for field splices and connections shall conform to ASTM A 325, Type 3. When allowed by the Engineer, they shall conform to ASTM A 325, Type 1 or 2, with hot-dipped galvanizing in accordance with ASTM A 153. Etching and painting shall be performed to match 595 standard color 20062.

The truss of post connections for box truss overhead supports shall be cast steel conforming to ASTM A 486, Class 90. Pins shall conform to ASTM A 108, Grade 1118. Pin holes in the casting shall be reamed to true size.

Reinforcing materials shall be in conformance with 709.1 to 709.4, inclusive, except that welded wire fabric may be furnished in rolls.

Anchor bolts shall be of sufficient size and strength to fully develop the bending moment of the shaft. Anchor bolts shall be fabricated from high strength steel having a minimum yield strength of ASTM A1554, Gr. 105 Each bolt shall be provided with two heavy hex nuts. Both nuts shall be hot-dipped galvanized and, as a minimum, meet the physical, chemical and dimensional requirements of ASTM A 307. Washers shall be of standard commercial grade steel having the dimensions shown on the Detail Drawings and be hot-dipped galvanized in accordance with ASTM A 153.

Filler metal for welds shall conform to the requirements of 615.5.7.

658.2.3-Concrete: Concrete for sign foundations shall be Class B in accordance with 601.

658.2.4-Reinforcing Steel Bars: Reinforcing steel bars shall conform to the applicable requirements of 602.

CONSTRUCTION METHODS

658.3-FABRICATION:

658.3.1-General: Before fabrication of any sign structure, the Contractor shall submit for the Engineer's approval complete detail drawings, eight copies, of each structure. This shall include drawings of all structural steel or aluminum framing and bracing, aluminum or steel castings, lighting fixtures and supporting brackets, sign brackets and any miscellaneous accessories for the above. It is expressly understood that the review by the Engineer of these drawings relates to the requirements for strength and general details, and will not relieve the Contractor from responsibility for errors in detail, dimension, or quantity of materials, etc.

Overhead sign supports shall be fabricated in accordance with the Plans and this Specification. Any alternate design or significant departure from the Plans proposed by the Contractor must be presented in written or plan form for approval. The Division will approve or disapprove alternate proposals in writing. All materials in any alternate proposal which is a significant departure from the Specifications shall conform to the requirements of current AASHTO and ASTM Specifications. The Division will not approve substitution of material or design detail changes which constitute a reduction in quality, workmanship or strength of the structures.

Ends of sections shall be cut true and smooth, free from burrs and ragged breaks. Open ends of tubular sections shall be capped as shown on the Plans. Drain holes and handholes shall be provided wherever shown or necessary.

Sign supports, either aluminum or steel, shall be void of circumferential welding except at the base, flanges, or intersection of diagonals.

The welding of steel shall be in accordance with the requirements of American Welding Society D1.1 and shall be done by qualified welders. Aluminum Alloy Welding shall be accomplished in accordance with 658.4.

The loading, transporting, unloading, and piling of structural materials shall be conducted so that the metal will be kept clean and free from injury in handling. Structural materials shall be stored above the ground upon platforms, skids, blocks, or other supports. They shall be kept free from accumulation of dirt, oil, acids, or other foreign matter. Any structural material which has been deformed shall be straightened by approval methods before being laid out, punched, drilled, or otherwise worked upon in the shop. Sharp kinks or bends will be cause for rejection.

Where required or indicated on the Plans, a sufficient number of reinforced handholes and electrical wire inlets and outlet fittings shall be built into the structures. Where a cable passes through a hole or runs along a surface at any point through or on the complete assembly, such holes and surfaces shall be deburred and void of any sharp edges through or along the surface. A "J" hook shall be provided on the inside of the top of the vertical support on which the electrical wiring shall be placed as shown on the Detail Drawings.

658.3.2-Structures Utilizing Galvanized Steel: The flanges at the center

658.3.3

of the cross beam and at the ends of the horizontal arms shall be fastened to the tapered or straight sections by means of two circumferential welds. One of the circumferential welds shall firmly weld the outside of the flange to the tube. Any alternate flange connection offered shall be designed to develop fully the strength of the tubular sections being jointed together by means of the flange connection.

It is essential that all exposed surfaces of the completed steel structure by finished with a galvanized coating. The frame shall be fabricated into sections as large as can be handled in pickling and galvanizing tanks and then dipped as complete units, ready for field bolted connections wherever possible. Field welding and the need for repairing zinc coatings damaged by assembly shall be kept to an absolute minimum.

Galvanized coatings damaged for any reason shall be repaired by the application of a zinc rich paint conforming to the requirements of 711.21.

The places to be painted shall be thoroughly cleaned before the paint is applied.

658.3.3-Structures Utilizing Weathering Steel: Overhead sign structures of weathering steel are to have a natural weathering finish and shall be kept clear of all paint, grease, or other agents which will tend to cause an uneven finish on the posts. Any identification marks shall be painted on the bottom of the base plates, inside faces of loose column components and the top surface of horizontal members. All structures shall be delivered to the job site at least three months prior to completion of the work and stored in a manner that will allow them to obtain initial natural weathering. If they are stacked on the job site during this period, they shall be rotated at least once each two months. All members shall be shop cleaned in accordance with 615.6.4, utilizing commercial blast cleaning throughout. No corrosion inhibitors shall be used in the processes.

All welding shall conform to the requirements of AWS D1.1.

658.4-WELDING OF ALUMINUM ALLOYS:

These specifications apply to the welding of aluminum alloys used in sign structures, bridge rails, lamp posts, etc.

The welding terms used in these specifications shall be interpreted in accordance with the definitions given in the latest edition of AWS Definitions--Welding and Cutting (AWS A3.0) of the American Welding Society.

The welding symbols used on plans shall be those shown in the latest edition of Standard Welding Symbols (AWS A2.0) of the American Welding Society. Special conditions shall be fully explained by added notes or details.

658.4.1-Base Metals: The aluminum alloys to be welded under these specifications may be any of the following alloy designations (ASTM designations):

- i. Wrought non-heat-treatable alloys

- Alloy 3003
- Alloy 3004
- Alloy 5052
- Alloy 5083
- Alloy 5086
- Alloy 5456
- ii. Wrought heat-treatable alloys
 - Alloy 6061
 - Alloy 6063
- iii. Cast heat-treatable alloys
 - Alloy 356.1
 - Alloy A356.2

658.4.1.1-Materials used for permanent backing shall be at least equivalent in weldability to the base metal being welded.

658.4.2-Welding Processes: These Specifications include provisions for welding by the gas metal-arc process and the gas tungsten-arc process. Other processes shall not be used except as permitted by the Engineer.

658.4.3-Filler Metal: Bare wire electrodes for use with gasmetal-arc process and welding rods for use with the gas tungsten-arc process shall conform to the requirements of the latest edition of Specifications for aluminum and aluminum alloy rods and bare electrodes AWS A5.10.

Tungsten electrodes for the gas tungsten-arc process shall conform to the requirements of the latest edition of Specifications for Tungsten-Arc-Welding Electrodes, AWS A5.12.

Filler metals to be used with particular base metals shall be as shown in Table 658.4.3. Other filler metals may be used as approved by the Engineer.

658.4.3

TABLE 658.4.3	
Base Metal	Filler Material
3003 to 3003	ER1100
3004 to 3004	ER4043
5052 to 5052	ER5356*
5083 to 5083	ER5183
5086 to 5086	ER5356*
5456 to 5456	ER5556
5670B to 6061	ER4043*
5670B to 6063	ER4043*
356.1 to 6061	ER4043
A356.2 to 6063	ER4043
6061 to 6063	ER4043 or ER5356
6061 to 6061	ER4043 or ER 5356
6063 to 6063	ER 4043 or ER5356

Filler metals shall be kept covered and stored in a dry place at relatively uniform temperatures. Original rod or wire containers shall not be opened until time to be used. Rod and wire shall be free of moisture, lubricant, or other contaminants. Spools of wire temporarily left unused on the welding machine shall be kept covered to avoid contamination by dirt and grease collecting on the wire. If a spool of wire is to be unused for more than a short length of time, it shall be returned to the carton and the carton tightly resealed.

658.4.4-Shielding Gases: Shielding gases shall be welding grade or better.

Shielding gas for gas metal-arc welding shall be argon, helium, or a mixture of the two (approximately 75 percent helium and 25 percent argon).

Shielding gas for gas tungsten-arc welding done with alternating current shall be argon.

Shielding gas for gas tungsten-arc welding done with direct current, straight-polarity, shall be helium.

Hose used for shielding gases shall be made of synthetic rubber or plastic. Natural rubber hose shall not be used. Hose which has been previously used for acetylene or other gases shall not be used.

658.4.5-Preparation of Materials: Joint details shall be in accordance

with design requirements and detail drawings. The locations of joints shall not be changed without the approval of the Engineer.

Edge preparation shall be by sawing, machining, clipping, or shearing. Gas tungsten-arc or gas metal-arc cutting may also be used. Cut surfaces shall meet the American Standards Association surface roughness rating value of 1,000. Oxygen cutting shall not be used.

Surfaces and edges to be welded shall be free from fins, tears, and other defects which would adversely affect the quality of the weld.

Dirt, grease, forming or machining lubricants or any organic materials shall be removed from the areas to be welded by cleaning with a suitable solvent or by vapor degreasing.

On all edges and surfaces to be welded, the oxide shall be removed just prior to welding by wire brushing or by other mechanical methods such as rubbing with steelwool or abrasive cloth, scraping, filing, rotary planing, or sanding. If wire brushing is used, the brushes shall be made of stainless steel. Hand or power driven wire brushes which have been used on other materials shall not be used on aluminum.

Where mechanical methods of oxide removal are found to be inadequate, a standard chemical method shall be used. Welding shall be done within 24 hours after chemical treatment.

When gas tungsten-arc welding with direct current, straight polarity is being used, all edges and surfaces to be welded shall have the oxide removed by a standard chemical method.

Welding shall not be done on anodically treated aluminum, unless the condition is removed from the joint area to be welded.

658.4.6-Welding Procedure: All butt welds requiring 100 percent penetration, except those produced with the aid of backing, shall have the root of the initial weld chipped or machined out to sound metal before welding is started from the second side. Butt welds made with the use of backing shall have weld metal thoroughly fused with the backing. Where accessible, backing for welds that are subject to computed stress or which are exposed to view on the completed structure and which are not otherwise parts of the structure, shall be removed and the joints ground or machined smooth. In tubular members, butt welds subjected to computed stresses shall be made with the aid of permanent backing rings or strips.

The procedure used for production welding of any particular joint shall be the same as used in the procedure qualification for that joint.

All welding operations, either shop or field, shall be protected from air currents or drafts so as to prevent any loss of gas shielding during welding. Adequate gas shielding shall be provided to protect the molten metal during solidification.

The work shall be positioned for flat position welding whenever practicable.

In both shop and field, all weld joints shall be dry at the time of welding.

658.4.7

The size of the electrode, voltage and amperage, welding speed, gas or gas mixture, and gas flow rate shall be suitable for the thickness of material, design of joint, welding position and other circumstances attending the work.

Gas metal-arc welding shall be done with direct current, reverse polarity.

Gas tungsten-arc welding shall be done with alternating current or with direct current straight polarity.

When the joint to be welded requires specific root penetration, the Contractor shall make a sample joint and a macroetched cross section of the weld to demonstrate that the joint welding procedure to be used will attain the required root penetration. The sample joint shall have a length of at least 1 ft. (300 mm) and shall be welded with the electrode, polarity, amperage, voltage, speed, gas mixture and gas flow rate that are proposed to be used in production welding. The Engineer, at their discretion, may accept evidence on record in lieu of the preceding test.

Where preheat is needed, the temperature of preheat shall not exceed 350° F (175 ° C) for heat-treated alloys or 600° F (315° C) for non-heat-treated alloys. The temperature shall be measured by temperature indicating crayons or by pyrometric equipment. Heat treated alloys shall not be held at the maximum preheat temperature or at temperatures near the maximum for more than 30 minutes.

658.4.7-Weld Quality: Regardless of the method of inspection, the acceptance or rejection of welds shall be determined by the following conditions:

- i. Cracks in welds or adjacent base metal will not be acceptable.
- ii. Copper inclusions will not be acceptable.
- iii. Porosity in excess of that permitted by Appendix IV, Section VII of the ASME Boiler and Pressure Vessel Code will not be acceptable.
- iv. Lack of fusion, incomplete penetration, or tungsten or oxide inclusions will be acceptable only if small and well dispersed.

Undercut shall not be more than 0.01 in. (250 µm) deep when its direction is transverse to the primary stress in the part that is undercut.

Undercut shall not be more than 1/32 in. (800 µm) deep when its direction is parallel to the primary stress in the part that is undercut.

No overlap shall be allowed.

All craters shall be filled to the full cross section of the welds.

Welds having defects greater than the levels of acceptance specified above shall be considered as rejected unless corrected in accordance with 658.4.9.

658.4.8-Inspection: To determine compliance with 658.4.7, all welds shall be visually inspected and, in addition, all welds subjected to computed stress shall be inspected by the dye penetrant method except as specified in 658.4.8.3.

658.4.8.1-For highway sign structures, the dye penetrant method shall be

used on butt welds in columns and main chord members, and on fillet welds connecting columns to bases and main chord members, including the associated flanges, gussets, or main load carrying brackets or members; also, on fillet welds connecting flanges to the main truss chord members.

658.4.8.2-The dye penetrant tests shall be performed in accordance with the requirements of ASTM E 165, Method B, Procedures B-2 or B-3.

658.4.8.3-Dye penetrant inspection may be omitted provided that the inspector examines each layer of weld metal with a magnifier of 3X minimum before the next successive layer is deposited.

658.4.9-Corrections: In lieu of rejection of an entire piece or member containing welding which is unacceptable, the corrective measures listed below may be permitted by the Engineer, whose approval shall be obtained prior to making each repair.

658.4.9.1-Defective welds shall be corrected by removing and replacing the entire weld, or as follows:

- i. Cracks in welds or base metal: Determine full extent of crack by dye penetrant method or other positive means. Remove crack throughout its length and depth, and reweld.
- ii. Excessive porosity, lack of fusion: Remove defective portions and reweld.
- iii. Copper or tungsten inclusions: remove defective portions and reweld.
- iv. Excessive concavity of crater, undercut, undersize weld Clean and deposit additional weld metal.
- v. Overlap: Reduce by removal of excess weld metal.

658.4.9.2-The defective areas shall be removed by chipping or machining. Oxygen cutting shall not be used. Before rewelding, the joint shall be inspected to assure that all the defective weld has been removed. If dye penetrant has been used to inspect the weld, all traces of penetrant solutions shall be removed with solvent, water, heat, or other suitable means before rewelding.

658.4.10-Qualification of Procedures, Welders and Welding Operators: Joint welding procedures which are to be employed in executing contract work under these specifications shall be previously qualified by tests prescribed in Part B, Section IX, of the ASME Boiler and Pressure Vessel Code. The qualifications shall be at the expense of the Contractor. The Engineer, at their discretion, may accept evidence of previous qualification of the joint welding procedures to be employed.

All welders and welding operators to be employed under these specifications shall be previously qualified by tests as prescribed in Part B,

658.5

Section IX, of the ASME Boiler and Pressure Vessel Code. The Engineer, at their discretion, may accept evidence of previous qualification of the welders and welding operators to be employed. The same process and type of equipment that is required for execution of the construction work shall be used in qualifying welders and welding operators.

658.5-ERECTION:

Erections of sign structures shall be in accordance with the applicable provisions of the current edition of the Standard Specifications and the requirements given below. The Contractor shall provide all tools, equipment and appliances necessary for the expeditious handling of the work, all of which shall be subject to the approval of the Engineer. Materials and workmanship not previously inspected will be inspected on the site of the work and all rejected material shall be removed from the site of the work.

In order to reduce the hazards of performing work over roadways and to provide sign loads to sign bridges immediately, the sections of a horizontal strut of any bridge shall be spliced together for the full length of one span and all sign panels, lighting and other accessories required thereon, as described elsewhere in these Specifications, shall be fully installed before erecting the complete assembly between the previously erected columns or as directed by the Engineer. The fully assembled structure shall be handled and erected in such a manner as not to damage any of the installations thereon.

Overhead sign supports shall provide a vertical clearance, between the bottom edge of the sign or luminaire support for the full width of the pavement and shoulders of not less than 17 feet (5.2 m).

The Contractor shall take full responsibility for checking all cross sections at approved sign locations to determine final sign structure dimensions.

Where cylindrical concrete footings are used, the concrete shall be placed against undisturbed earth. Earth augers, if used shall be of the same diameter as the footings. Where a trench is required, it shall be only as wide and long as is necessary to accommodate the work. The excavation shall be made in accordance with the applicable provisions of the Standard Specifications. All excavations shall be backfilled with suitable random material in horizontal layers not to exceed 4 inches (100 mm) after compaction. Each lift shall be compacted to the satisfaction of the Engineer. Testing is not required. All surplus material shall be removed from the right-of-way and the backfill finished flush with surrounding natural ground, including replacement of any damaged facilities or appurtenances. The Contractor shall restore all areas disturbed by this excavation or other operations to their original conditions including grading, seeding, mulching and fertilizing as directed by the Engineer.

If rock or boulders are encountered during the excavation, they shall be removed to a depth sufficient, in the opinion of the Engineer, to obtain the stability necessary to support the complete sign structure.

The footings shall be of Class B concrete, reinforced, of the types shown on the Plans. Steel reinforcement, anchor bolts and conduit for the footings shall

be as shown on the Plans.

All overhead sign structures shall have ground rods,irregardless of whether they have sign lighting or other electrical components. Ground rods shall be copperclad steel, $\frac{3}{4}$ inches (19 mm) in diameter with a minimum length as noted on the Plans and shall be one piece. Sectional or segmented ground rods are not permitted. The ground rods shall be complete with ground clamp and square head bolt.

The anchor bolts shall be set accurately, by means of a template in the position shown on the drawings and held rigidly in the forms so as to avoid displacement during the pouring of concrete. The steel reinforcement and conduit shall have been properly placed and secured before the pouring of concrete. The Contractor shall make periodic checks of the bolt positions and elevations during concreting operations. It is essential that the distance between the centers of anchor bolt groups of the two or three foundations of a frame be exactly the span lengths shown on the Plans.

Two inch (50 mm) diameter galvanized conduit shall be furnished and installed in the post foundations at locations as specified on the Plans. The conduit shall terminate above the top of the foundation and shall be fitted with a 2 in. (50 mm) capped grounding bushing above the foundation. The lower end of the conduit shall emerge from the side of the footing to be joined to conduit from the junction box.

The entire structure shall be erected and adjusted for plumbness, grades and alignment by the manipulation of the leveling nuts on the anchor bolts.

Electrical materials and other installations need not be in place on the columns at the time of column erection.

Brackets for attaching signs shall be spaced as shown on the Standard Drawings or the Plans. There shall be a minimum of two brackets per sign.

The field assembling of the component parts of a structure shall be done in a manner not likely to produce damage by twisting, bending, or otherwise deforming the metal. Any member slightly bent or twisted shall have all defects corrected in an approved manner before being placed. Members seriously damaged will be rejected. All exposed surfaces shall be free of blemishes and scratches. Painting will not be allowed. Just prior to erection, the aluminum shall be thoroughly cleaned and any accumulations of oil, grease, dirt or foreign materials shall be removed by the use of an approved solvent cleaner.

Protection of aluminum is required where aluminum members are to be attached to concrete masonry or steel which is neither galvanized nor stainless.

To avoid the possibility of corrosion, aluminum members attached to such bare steel shall be coated at the points of contact with a zinc chromate primer or as called for on the Plans. The surfaces of steel members, nongalvanized, shall likewise be coated at the points of contact with a suitable priming paint and this shall be followed by a coat of aluminum paint. Where aluminum surfaces are to be in contact with concrete or masonry, they shall first be given a heavy coat of an alkali-resistant bituminous paint.

658.5.1 - Erection of Columns or Cantilever Uprights:

- I. Place leveling nuts, then washers on anchor bolts at level position.
- II. Insure anchor bolts and the bolt holes in base plate are properly aligned.
 - a. No cold working of bolts will be allowed.
 - b. No cutting or reaming of holes will be allowed without prior approval from the Traffic Engineering Division.
- III. Place column or cantilever upright onto the anchor bolts.
- IV. Hold column or cantilever upright at true plumb.
 - a. Adjust leveling nuts as necessary (column may not always be exactly perpendicular to base plate due to welding distortion, etc.).
- V. All bolts will be coated with either of the following waxes Jon Cote 639 or MacDermid Torque 'N Tension Control Fluid. The top anchor bolt nuts must be installed the same day that the wax is applied to the anchor bolts.
- VI. Place washers, then the top anchor bolt nuts on the anchor bolts.
- VII. Snug the anchor bolt nuts alternating corner-to-corner and side-to-side. Snug tight is defined as the tightness which exists due to the full effort of a man using a spud wrench with the appropriate length handle for the bolt being tightened. The following chart indicates the size of the wrench to be used when snugging bolts:

<u>BOLT DIAMETER</u>	<u>HANDLE LENGTH OF WRENCH</u>
¾ in (19.05 mm)	23" (575 mm)
7/8 in (22.23 mm)	23" (575 mm)
1 in (25.40 mm)	23" (575 mm)
1¼ in (31.75 mm)	23" (575 mm)
1½ in (38.10 mm)	36" (900 mm)
1¾ in (44.45 mm)	36" (900 mm)
2 in (50.80 mm)	36" (900 mm)
2¼ in (57.15 mm)	36" (900 mm)

- VIII. Apply 1/3 turn to each nut in the same sequence as snugging. Mark top anchor bolt nuts, anchor bolts, and base plate for reference to insure proper rotation is achieved. A hydraulic torque wrench meeting the minimum requirements specified

658.6.2

must be used to properly tension the anchor bolt nuts. Breaker bars, cheater bars, air wrenches, or other mechanical devices will not be allowed as they cannot achieve the proper tension.

- IX. Release any load by crane or other erection device. The anchor bolt nuts must be properly tightened before removal of the crane.
- X. Check structure. If problems exist such as the anchor connections are loose, then repeat the nut tightening procedure.

658.5.2 - Connection of Spans:

- I. Lift span, with signs, lighting and other accessories attached, to columns and insure bolts and bolt holes properly aligned.
- II. Insure connecting plates fit with no burrs or other seating inhibitors.
- III. Install bolts, nuts, and washers to snug tight, corner-to-corner and side-to-side. Use the above chart to determine a proper size wrench for snugging bolts. All bolts will be properly waxed before the nuts are installed.
- IV. Apply appropriate rotation to turning element in the same sequence as snugging and for high strength bolts in accordance with Table 615.3.214B of the Standard Specifications.
- V. Check structure. If problems exist, such as loose arm connections or showing gaps, the load must be removed from the area in question and steps repeated as necessary.

658.5.3 - Hydraulic Torque Wrench Specifications:

Anchor bolt nuts may only be tightened by a hydraulic wrench with a Minimum Capacity of 5300 ft. lbs. (7,180 Newton Meter), and must be capable of tightening or loosening.

658.5.4 - Verification of Contractor's Equipment and Personnel:

The Contractor will contact the Materials Control, Soils and Testing (MCS&T) Section ten working days prior to erection of the first sign structure. MCS&T personnel will meet with the inspector and contractor to verify installation procedures.

658.6-METHOD OF MEASUREMENT:

658.6.1-Class B Concrete Footing, Reinforced, Overhead: The quantity of work done for Class B Concrete Footings, Reinforced, Overhead will be measured in cubic yards (meters), complete in place and accepted, as determined by the dimensions on the Plans or Contract documents and will be the number of cubic yards (meters) established in the Proposal, subject to adjustment as provided for in [104.2](#) and [109.2](#).

658.6.2-Overhead Sign Structures: Measurement for payment for overhead sign structures will be based on each unit complete in place, which will include

658.7

the various elements of the structure consisting of vertical end support units, horizontal units, vertical sign brackets, structural framing for signing if required, sign lighting support hardware if required (horizontal brackets, pads, bolts, nuts, plates, etc.) and any other accessories or hardware as required to make a complete installation as called for on the Plans or as directed by the Engineer.

658.7-BASIS OF PAYMENT:

The quantities, determined as provided above, shall be paid for at the contract unit price for the items listed below, which prices and payment shall be full compensation for furnishing all the materials and doing all work prescribed in a workmanlike and acceptable manner, including staking out footings and stakes therefore; excavating for footings regardless of the type of material encountered; constructing and removing forms; furnishing and installing reinforcing steel, anchor bolts, washers and nuts; furnishing and installing electrical grounding and conduit sleeves; furnishing, placing, finishing and curing the concrete; furnishing and placing grout as required by the Plans; fabrication, delivery and erection of each overhead sign; and including all tools, equipment, supplies and incidentals necessary to complete the work. All incidental work and materials for which no basis of payment is provided will be considered as completely covered by the prices bid for the items included in the contract.

658.8-PAY ITEMS:

ITEM	DESCRIPTION	UNIT
658001-*	CLASS B CONCRETE FOOTINGS, REINFORCED, OVERHEAD	CUBIC YARD (METER)
658002-*	OVERHEAD SIGN, STEEL-ALUMINUM COMBINATION	EACH
658003-*	OVERHEAD SIGN, GALVANIZED STEEL	EACH
658004-*	OVERHEAD SIGN, WEATHERING STEEL	EACH

* Sequence number

SECTION 659

SIGN LIGHTING

659.1-DESCRIPTION:

Sign lighting shall consist of furnishing and installing or modifying sign illumination systems, including all necessary accessories, in accordance with the Plans and the following Specifications or as directed by the Engineer.

All electrical equipment shall conform to the standards of the National Electrical Manufacturers Association (NEMA), the Underwriters' Laboratories, Inc. (UL), or the Electronic Industries Association (EIA), whichever is applicable. In addition to the requirements of the Plans and these Specifications, all materials and workmanship shall conform to the requirements of the National Electrical Code (NEC), referred to as the Code; the American Society for Testing Materials (ASTM); the American National